

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A method computer program product comprising a computer useable medium having computer readable code embodied therein for modeling the availability of a cluster, the cluster having a plurality of software components and at least one node, the method comprising the computer program product adapted when run on a computer to effect steps including:

determining a plurality of component availability models using a repair model and a plurality of failure parameters, each of the plurality of component availability models corresponding to one of the plurality of software components, wherein the plurality of failure parameters include a failure rate, repair rate and efficacy;

combining the plurality of component availability models, wherein the combining step further comprises obtaining aggregate failure rates, aggregate repair rates, and aggregate efficacies for the plurality of component availability models and wherein the aggregate failure rates, the aggregate repair rates and the aggregate efficacies are obtained for each repair mode in the repair model;

determining repair rates for node and cluster reboots; and

constructing an availability model based on the repair rates and the combined plurality of component availability models[.] :

wherein for each repair mode in the repair model, an aggregate failure rate is a sum of failure rates of the plurality of software components for the repair mode,

wherein for each repair mode in the repair model, an aggregate repair rate is a weighted average of repair rates of the plurality of software components for the repair mode, weights being corresponding failure rates of the plurality of software components for the repair mode, and

wherein for each repair mode in the repair model, an aggregate efficacy is an weighted average of efficacies of the plurality of software components for the repair mode, weights being corresponding failure rates of the plurality of software components for the repair mode.

Claim 2 (original): The method of claim 1, wherein the repair model includes one or more repair modes.

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

Claim 3 (currently amended): The method of claim 2, wherein the one or more repair modes of the repair model include component soft-[[restart]] reset, component warm-restart, component cold-restart, component fail-over, node reboot and cluster reboot.

Claims 4-6 (cancelled)

Claim 7 (currently amended): The method of claim [[4]] 1, wherein the combining step further comprises:

for each repair mode in the repair model, aggregating failure rates of each of the plurality of software components;

for each repair mode in the repair model, aggregating repair rates of each of the plurality of software components; and

for each repair mode in the repair model, aggregating efficacies of each of the plurality of software components.

Claim 8 (original): The method of claim 1, wherein the determining repair rates step further comprises:

specifying times that a bare platform and the cluster requires for rebooting a node and the cluster;

specifying an efficacy for node reboots;

defining cluster specific summation functions for obtaining restart times; and combining the restart times.

Claim 9 (original): The method of claim 1, wherein the determining the plurality of component availability models step further includes,

building an escalation graph for each of the plurality of software components.

Claim 10 (original): The method of claim 9, wherein the escalation graph for each software component includes a weighted directed graph with its nodes representing repair modes for the software component and its edges having transition rates.

Claim 11 (original): The method of claim 1, wherein the constructing step further comprises:

calculating a plurality of state-space parameters;

constructing a state-space model of the cluster; and

solving the state-space model.

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

Claim 12 (original): The method of claim 11, wherein the plurality of state-space parameters include aggregate failure rates, aggregate repair rates, aggregate efficacies, and the repair rates for node and cluster reboots, and
wherein an aggregate failure rate, an aggregate repair rate and an aggregate efficacy is assigned to each repair mode in the repair model.

Claim 13 (original): The method of claim 11, wherein the state-space model is represented as a weighted directed graph with its nodes representing states and its edges having transition rates.

Claim 14 (original): The method of claim 13, wherein the states are based on the repair model.

Claim 15 (original): The method of claim 1, wherein the plurality of component availability models include models for operation system software and models for non-operating system software.

Claim 16 (currently amended): A system for modeling the availability of a cluster, the cluster having a plurality of software components and at least one node, the system comprising:

means for determining a plurality of component availability models using a repair model and a plurality of failure parameters, each of the plurality of component availability models corresponding to one the plurality of software components,
wherein the plurality of failure parameters include a failure rate, repair rate and efficacy;

means for combining the plurality of component availability models, wherein the combining means comprises means for obtaining aggregate failure rates, aggregate repair rates, and aggregate efficacies for the plurality of component availability models and wherein the aggregate failure rates, the aggregate repair rates and the aggregate efficacies are obtained for each repair mode in the repair model;

means for determining repair rates for node and cluster reboots; and

means for constructing an availability model based on the repair rates and the combined plurality of component availability models[[.]] :

wherein for each repair mode in the repair model, an aggregate failure rate is a sum of failure rates of the plurality of software components for the repair mode,

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

wherein for each repair mode in the repair model, an aggregate repair rate is a weighted average of repair rates of the plurality of software components for the repair mode, weights being corresponding failure rates of the plurality of software components for the repair mode, and

wherein for each repair mode in the repair model, an aggregate efficacy is a weighted average of efficacies of the plurality of software components for the repair mode, weights being corresponding failure rates of the plurality of software components for the repair mode.

Claim 17 (original): The system of claim 16, wherein the repair model includes one or more repair modes.

Claim 18 (currently amended): The system of claim 17, wherein the one or more repair modes of the repair model include component soft-[restart] reset, component warm-restart, component cold-restart, component fail-over, node reboot and cluster reboot.

Claims 19-21 (cancelled)

Claim 22 (currently amended): The system of claim [[19]] 16, wherein the combining means further comprises:

for each repair mode in the repair model, means for aggregating failure rates of each of the plurality of software components;

for each repair mode in the repair model, means for aggregating repair rates of each of the plurality of software components; and

for each repair mode in the repair model, means for aggregating efficacies of each of the plurality of software components.

Claim 23 (original): The system of claim 16, wherein the determining repair rates means further comprises:

means for specifying times that a bare platform and the cluster requires for rebooting a node and the cluster;

means for specifying an efficacy for node reboots;

means for defining cluster specific summation functions for obtaining restart times; and

means for combining the restart times.

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

Claim 24 (original): The system of claim 16, wherein the determining the plurality of component availability models means further includes,
means for building an escalation graph for each of the plurality of software components.

Claim 25 (original): The system of claim 24, wherein the escalation graph for each software component includes a weighted directed graph with its nodes representing repair modes for the software component and its edges having transition rates.

Claim 26 (original): The system of claim 16, wherein the constructing means further comprises:

means for calculating a plurality of state-space parameters;
means for constructing a state-space model of the cluster; and
means for solving the state-space model.

Claim 27 (original): The system of claim 26, wherein the plurality of state-space parameters include aggregate failure rates, aggregate repair rates, aggregate efficacies, and the repair rates for node and cluster reboots, and
wherein an aggregate failure rate, an aggregate repair rate and an aggregate efficacy is assigned to each repair mode in the repair model.

Claim 28 (original): The system of claim 26, wherein the state-space model is represented as a weighted directed graph with its nodes representing states and its edges having transition rates.

Claim 29 (original): The system of claim 28, wherein the states are based on the repair model.

Claim 30 (original): The system of claim 16, wherein the plurality of component availability models include models for operation system software and models for non-operating system software.

Claim 31 (currently amended): A computer program product comprising a computer useable medium having computer readable code embodied therein method for modeling the availability of a cluster, the cluster having a plurality of software components and at least one node, the computer program product adapted when run on a computer to effect steps including the method comprising:

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

specifying a repair model, the repair model having one or more repair modes;
specifying a plurality of failure parameters,
for each software component in the plurality of software components,
assigning values to the plurality of failure parameters for each appropriate repair
mode for the software component;
constructing an escalation graph for each of the plurality of software
components;
combining values of the plurality of failure parameters of the plurality of
software components for each repair mode in the repair model;
determining repair rates for node and cluster reboots; and
constructing an availability model based on the repair rates and the combined
plurality of failure parameters.

Claim 32 (cancelled)

Claim 33 (currently amended): The method of claim 31, wherein the one or more
repair modes include component soft-[restart] reset, component warm-[reset]
restart, component cold-restart, component fail-over, node reboot and cluster reboot.

Claim 34 (original): The method of claim 31, wherein the plurality of failure
parameters includes a failure rate, repair rate and efficacy.

Claim 35 (original): The method of claim 31, wherein the combining step further
includes:

for each repair mode in the repair model, aggregating values of each of the
plurality of failure parameters.

Claim 36 (cancelled)

37 (new): A computer-based method for incorporating a software component into a
model of a network, comprising:

determining failure rates for warm recoverable errors and non-warm
recoverable errors of said software component, wherein the warm recoverable errors
comprise application failures that can be corrected by a restart without loss of state
of the application and the non-warm recoverable errors comprise application failures
that can be corrected by a restart with loss of state of the application;

determining recovery rates for the warm recoverable errors and the non-warm
recoverable errors of said software component;

Serial No. 10/076,505
Reply to Office Action of December 13, 2005

with a network modeling application running on a computing device, generating warm recoverable error state parameters from said warm recoverable error failure rates and said warm recoverable error recovery rates;

with the network modeling application, generating non-warm recoverable error state parameters from said non-warm recoverable error failure rates and said non-warm recoverable error recovery rates;

operating the network modeling application to construct the model of the network including the warm recoverable error state parameter and the non-warm recoverable error state parameters for the software component; and
storing the model of the network in memory.

38 (new): The method of claim 37, further comprising with the network modeling application receiving network recovery parameters, including network reboot parameters.